

wherein a percentage of  $sp^3$  carbon-carbon bonds in the layer increases as a layer thickness decreases.

REMARKS

Claims 38-46, 48-59, and 61-63 were examined. Claim 59 has been amended to more clearly claim the present invention. Re-examination and reconsideration of the pending claims are respectfully requested.

Formal Matters

Applicants are submitting supplemental ADS sheets herewith to correct an inadvertent clerical error on the CPA Transmittal Request. The inventor name now correctly recites Vijayen Veerasamy. Moreover, the previously filed declaration under 37 C.F.R. § 1.63 and cover page of the filed application correctly recite Veerasamy as the surname.

Substantive Rejections

Claims 38-46, 48-59, and 61-63 have been rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over the Doctoral Dissertation by Vijayen Veerasamy or in combination with the Doctoral Dissertation by Manfred Weiler and U.S. Patent No. 4,749,608, issued to Nakayama et al. Such rejections are traversed as follows.

Generally, Applicants note that the Examiner has failed to establish *prima facie* obviousness under 35 U.S.C. § 103 and M.P.E.P. §§ 2142-2143. Firstly, the Examiner has not established that the prior art references, alone or in combination, teach or suggest all the claim limitations. M.P.E.P. § 2143.03; *In re Royka*, 180 U.S.P.Q. 580 (CCPA 1974). Secondly, no suggestion or motivation, either in the cited references or in the knowledge generally available to one of ordinary skill in the art, has been cited by the Examiner for the proposed modifications to the teachings of the references so as to produce the claimed invention. M.P.E.P. § 2143.01; *In re Fine*, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988). Finally, the Examiner has not show that one of ordinary skill in the art would have had a reasonable expectation of success in carrying out the claimed invention based on the cited references. M.P.E.P. § 2142; *In re Vaeck*, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991).

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Claim 38 recites an article comprising a substrate and a layer disposed over the substrate. The layer comprises a highly tetrahedral amorphous carbon having more than about 15%  $sp^3$  carbon-carbon bonds and a single peak Raman spectrum, the layer further comprising at least one of hydrogen and nitrogen. In particular, claim 38 recites that a percentage of  $sp^3$  carbon-carbon bonds in the layer increases as a layer thickness decreases. Tetrahedral amorphous carbon films having such a unique material property are not shown or reasonably suggested in the cited art.

The Veerasamy dissertation fails to describe or suggest a highly tetrahedral amorphous carbon layer having a percentage of  $sp^3$  carbon-carbon bonds which increases with a decreasing layer thickness, as presently claimed by claim 38. The Examiner bases his Veerasamy rejection for "the reasons of record", presumably for the reasons stated in the Office Action of August 22, 2001. Office Action dated June 18, 2002, page 2. However, as this proposed limitation of a tetrahedral amorphous carbon layer having  $sp^3$  carbon-carbon bonding which increases with decreasing layer thickness was added to claim 38 after the office action of August 22, 2001, it is not clear what portion of the Veerasamy reference, or what knowledge in the art, teaches or suggest the proposed modification. In fact, a close examination of this reference reveals that  $sp^2$  carbon-carbon bonding, i.e. graphite, increases with decreasing layer thickness. Veerasamy Dissertation, pages 115-117, Section 4.3.3 Thickness Dependence of  $SP^2$ -Bonded Fraction. Specifically, Veerasamy investigates the relationship between  $sp^2$  bonding as a function of thickness of the tetrahedral amorphous carbon and concludes that,

there is a also a noticeable increase in the relative intensity of the  $1s \rightarrow \pi^*$  peak with decreasing ta-C film thickness from 200 nm [2000 Å] down to 10 nm [100 Å]. This indicates an enhancement in  $sp^2$  contribution in the thinner films .... This imply that the  $sp^2$  fraction within the bulk of the thinnest film is highest.

*Id.*

Hence, Veerasamy effectively teaches away from Applicants invention of a tetrahedral amorphous carbon layer having  $sp^3$  carbon-carbon bonding which increases

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with decreasing layer thickness, as the Veerasamy Dissertation acknowledges that its thinnest layers promote the highest formation of  $sp^2$  bonding. Applicants note that a prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 220 U.S.P.Q. 303 (Fed. Cir. 1983). A person of ordinary skill in the art, upon review of the Veerasamy reference, would not have had a reasonable expectation of success to produce a thin highly tetrahedral amorphous carbon film to promote the highest formation of  $sp^3$  carbon-carbon bonding as Veerasamy indicated that the thinnest films promote the highest formation of  $sp^2$  carbon-carbon bonding.

With respect to the Weiler reference, Applicants fail to see even a remote teaching or suggestion for a highly tetrahedral amorphous carbon layer having a percentage of  $sp^3$  carbon-carbon bonds which increases with a decreasing layer thickness, as presently claimed by claim 38. Nonetheless, the Examiner asserts that "it would have been obvious to one of ordinary skill in the art to use the method and apparatus of Weiler to produce layers of highly tetrahedral amorphous carbon optimizing properties within the ranges disclosed by Weiler and/or Veerasamy tailored to a particular end use." Office Action dated June 18, 2002, page 3. Further, the Examiner requests that "since both Mr. Veerasamy and Mr. Weiler are named as inventors of the present application it is requested that they particularly point out the unobvious advances of the present invention from their previous work." *Id.*

Applicants point out that the Examiner bears the initial burden of factually establishing and supporting any *prima facie* conclusion of obviousness. *In re Rinehart*, 189 U.S.P.Q. 143 (CCPA 1976); M.P.E.P. § 2142. If the Examiner does not produce a *prima facie* case, the Applicant is under no obligation to submit evidence of nonobviousness. *Id.* The Examiner has not pointed to any evidence in the reference teaching of Veerasamy and/or Weiler which teaches or suggest their modification or combination to produce a highly tetrahedral amorphous carbon layer having a percentage of  $sp^3$  carbon-carbon bonds which increases with a decreasing layer thickness.

Applicants request, if the present rejection is maintained, that the Examiner show or explain where the cited references, or how knowledge of those skilled

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in the art, teach or suggest the proposed limitation of claim 38. See In re Zurko, 59 U.S.P.Q.2d 1693 (Fed Cir. 2001) ([I]n a determination of patentability .... the Board cannot simply reach conclusion based on its own understanding or experience - or on its assessment of what would be basic knowledge or common sense. Rather, the Board must point to some concrete evidence in the record in support of these findings.) Absent any cited teaching, suggestion, or reasonable motivation in the cited art for the novel and nonobvious physical characteristic of a highly tetrahedral amorphous carbon layer having a percentage of  $sp^3$  carbon-carbon bonds which increases with decreasing layer thickness, *prima facie* obviousness has not been established. As such, Applicants respectfully request that the rejection under 35 U.S.C. § 103(a) be removed and that claim 38 (and the dependent claims 39-46 and 48-58) be allowed.

Dependent claims 53 and 54 are further allowable as these claims recite that the highly tetrahedral amorphous carbon layer has a thickness of less than about 75 Å and 50 Å, respectively. The Veerasamy and Weiler references do not teach or suggest such thin films. The Examiner asserts that it would have been obvious to one of ordinary skill in the art to use the carbon layer of Veerasamy or Weiler on the medium of Nakayawa et al. Office Action dated June 18, 2002, page 3. As stated above, *prima facie* obviousness requires that there must be some suggestion or motivation to combine the reference teachings so as to produce the claimed invention. The Examiner must further show that one of ordinary skill in the art would have had a reasonable expectation of success in carrying out the claimed invention based on the cited references. The obviousness rejection stated by the Examiner fails on these two criteria.

Based on the Veerasamy, Weiler, and Nakayama et al. references, one of ordinary skill in the art would not have been motivated to combine these teachings to produce Applicants' claimed invention. Specifically, there is no suggestion or motivation whatsoever in any of the references themselves to combine their teachings. The Nakayama et al. patent describes plasma-polymerized film consisting of carbon and hydrogen and having a thickness of 3 Å to 15 Å. This reference fails to teach or suggest a highly tetrahedral amorphous carbon layer having more than about 15%  $sp^3$  carbon-carbon bonds, much less a layer whose  $sp^3$  carbon-carbon bonds increases with

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decreasing thickness layer. As noted above, the Veerasamy reference provides no reasonable expectation of success in growing such tetrahedral amorphous carbon thin films as this reference indicates that the thinnest films promote the highest formation of  $sp^2$  carbon-carbon bonding. Hence, Applicants ask that the Examiner disclose where the reference teachings themselves would motivate one of ordinary skill to combine these teaching to recognize that a highly tetrahedral amorphous carbon layer may have a film thickness less than about 75 Å and 50 Å, respectively.

Independent claims 59, 62, and 63 are directed to an article comprising a substrate and a layer disposed over the substrate, wherein the layer comprises a highly tetrahedral amorphous carbon having a percentage of  $sp^3$  carbon-carbon bonds which increases with decreasing layer thickness. Hence, these claims should be allowable for many of the reasons given above regarding claim 38.

#### CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,



Nena Bains  
Reg. No. 47,400

TOWNSEND and TOWNSEND and CREW LLP  
Two Embarcadero Center, 8<sup>th</sup> Floor  
San Francisco, California 94111-3834  
Tel: (415) 576-0200 Fax: (415) 576-0300

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**VERSION WITH MARKINGS TO SHOW CHANGES MADE**

59. (Twice Amended) An article comprising:  
a substrate; and  
a layer disposed over the substrate, the layer comprising a highly tetrahedral amorphous carbon having more than about 15%  $sp^3$  carbon-carbon bonds and a single peak Raman spectrum, the layer further comprising at least one of hydrogen and nitrogen, wherein the  $sp^3$  carbon-carbon bonds are at least in part formed by directing an energized stream of carbon ions having a uniform weight and a substantially uniform impact energy toward the substrate;  
wherein a percentage of  $sp^3$  carbon-carbon bonds in the layer increases as a layer thickness decreases.

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